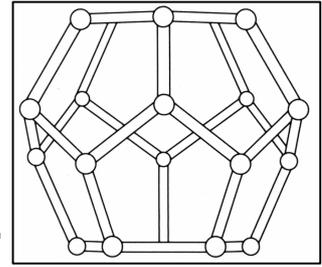

Zotefoams plc

Technical Information Sheet – TIS 01F Product Specification



ZOTEFOAMS ZOTEK® F BRAND FOAM PRODUCTS

The information below is the Zotefoams plc general specification for each of the products identified, unless otherwise agreed between Zotefoams and the customer. Normally, the foam attributes and properties would be expected to fall well within the limits given in this document, but occasionally properties may approach these limits.

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This specification may be amended periodically in line with our policy of continual improvement. For critical applications or significant new projects we would recommend that customers contact the Zotefoams Sales department before ordering.

1. GENERAL INFORMATION

The ZOTEK[®] F brand products comprise a range of crosslinked, closed cell foams, physically blown using pure nitrogen gas and based on the polymer Kynar[®] PVDF. All grades are thermoformable, though the degree of detail and complexity of moulding possible will vary between grades.

The ZOTEK F brand products are manufactured and sold as essentially rectangular sheets (sometimes known as buns or blocks) in a range of sizes, all having process skin surfaces. Talc residues or other processing aids may be present on the skin surfaces.

All information within this specification refers to the products in the form of sheets with process skins unless otherwise stated.

2. PRODUCT DESCRIPTIVE CODES

All ZOTEK F foam products are identified by a descriptive code based on a system that distinguishes the polymer category, nominal density, variant type (if applicable) and colour in that order.

*i) **Polymer Code:*** All PVDF foam products are identified by the descriptive code “F”. Within the range other PVDF polymers are identified by the additional description “HT”.

e.g. ZOTEK F30 and ZOTEK F40HT are both PVDF foams but use a different grade of PVDF polymer.

*ii) **Density Code:*** 2 or 3 digits describing the nominal density (in kg/m³)

*iii) **Variant Code:*** Where special properties have been imparted to foam, a variant code is used to identify these:

LS – Lower smoke emission

OSU – Low heat release

*iv) **Cell Size Code:*** Where grades are made available in more than one cell size range [see Table 1 for product cell size ranges], then an additional description code is used to identify the cell size of the product:

*e.g. ZOTEK F30 - Base product coding (no code suggests standard cell size)
ZOTEK F30 LC - Large cell variant*

Cell size has no implication for density. In the example above the density of both ZOTEK F30 and ZOTEK F30 LC products should be equivalent (accepting normal density distribution) and only the cell dimensions will have changed.

It is important to recognise that as foam density increases then product cell size, as a rule, will increase. This is more clearly shown in Table 1.

vi) **Colour Code:** Full colour name in English.

vii) **As an example of all of the above:**

ZOTEK® F40HT LS White = ZOTEK branded PVDF foam with a nominal foam density of 40 kg/m³, higher temperature variant polymer with lower smoke performance and white in colour.

3. PRODUCT TYPES

i) **Sheets, rolls and laminated sheets:** Are classified as:

skin/skin (s/s)	skin/cell (s/c)	cell/cell (c/c)
Product retains both process skin surfaces.	Product has one process skin removed.	Product has both process skins removed.

Note: Any product may have had one or more edge skins removed.

ii) **Fabricated products:** May then be further subdivided into:

- o **Untrimmed:** Produced from full size sheets but supplied with untrimmed edges. The useable size will be subject to the tolerances in Table 5.

Note: Due to sheet alignment some loss on overall size will occur.

- o **Trimmed:** Fabrications have edges trimmed to size and will be useable over the whole size supplied subject to the tolerances in Table 5.

Note: When ordering fabricated sheets and rolls it is necessary to specify the finish required using a combination of the above, e.g. untrimmed c/c, trimmed s/s, etc.

4. PRODUCT SIZE

i) **Sheets** [Test method : ISO 1923:1995]

Sheet sizes are defined by length, width and thickness. Nominal dimensions are the dimensions specified on the acknowledgement of order. For skin/skin sheets nominal dimensions (process skins are considered an integral part of the sheet) are the minimum dimensions and will always be met or exceeded. For cell/cell and skin/cell tolerances see "Fabricated Items" below.

Relating to Sections 4 and 6 the following applies; A skin/skin sheet showing any surface fault or defect is considered to be in specification providing that a specification cell/cell sheet can be obtained (e.g. a 2000 mm x 1000 mm x 27 mm specification cell/cell sheet shall be obtainable from nominal 2000 mm x 1000 mm x 30 mm skin/skin sheet of ZOTEK F40HT).

ii) Fabricated Items [Test method : ISO 1923:1995]
Fabrication tolerances are shown in Tables 5, 6 & 7.

5. PRODUCT PROPERTIES

i) Density [Test method : BS ISO 7214:1998]
Foam densities are measured with process skins intact unless otherwise stated. Density ranges by product are given in Table 1. The density range applies irrespective of foam sheet size or colour.

ii) Mechanical Properties [Test method : Technical Data Sheets]
Technical data sheets are published listing a range of property values relating to Zotefoams ZOTEK F brand foam products. The data sheet property values are typical of the material and are intended to provide guidance to customers; they do not constitute a specification and different product designations with the same properties on the data sheet will have different manufacturing tolerances.

Where a specification is required, this should be made and agreed in writing with Zotefoams plc Quality Assurance Department

6. PRODUCT APPEARANCE

i) Voids [Test Method : Zotefoams Internal]
The method takes into account the perceived seriousness of the void in so much as small voids ($\geq 1 - \leq 2$ mm diameter) are assessed by physical count of an area of a square metre, medium sized voids ($> 2 - \leq 4$ mm diameter) are counted and then the sum of the cube of all the diameters is quoted per square metre (i.e. one 3 mm diameter void in $1 \text{ m}^2 = 27$). Large voids ($> 4 - \leq 5$ mm & > 5 mm in diameter) are physically counted over an extended area of 15 m^2 .

Zotefoams categorises products into by void type and level. All ZOTEK F products are category C. A description of this void level is given in Table 2.

ii) Cell Size [Test method : Zotefoams Internal]
Cell size ranges by product are given in Table 1.

iii) Colour [Test method : Zotefoams Internal]
The colour shall be essentially visually uniform within the foam structure of a sheet. However, variation may be found between production Lots and/or individual sheets. A characteristic of PVDF polymer is the presence of occasional brown specs, a minor effect from the manufacturing process. These manifest themselves as brown spots in the foam. Zotefoams reject raw material with excessive brown spots but a small number should be expected. The maximum will be less than 10 brown spots, with maximum 10 mm diameter, per square metre.

The colour appearance of product will be affected by cell size; for the same colour product, larger cell size appears darker, smaller cell size appears lighter. Perceived colour will therefore be affected by the cell size ranges in Table 1.

iv) Surface Condition [Test method : Zotefoams Internal]

The products as manufactured will normally show an embossed pattern on one process skin surface. All process skins may occasionally have slight surface marks, indentations or discolouration. Talc residues, water, other processing aids or paint marks used by Zotefoams plc during manufacture may be present on the skin surfaces and/or edges. No guarantee is offered in relation to the skin surface.

v) Internal Condition [Test method : Zotefoams Internal]

The products as manufactured may show internal patterns and markings within the cellular structure. Such appearance faults may be very subtle and would not normally affect foam performance.

vi) Sheet Flatness (cell/ cell)[Test method : Zotefoams Internal]

When sheets are split some waviness may occur at the edges of the sheet. The amplitude and frequency is dependent on the thickness of the split sheet, the original sheet thickness, the product density and the process history of the sheet. Typically a 6 mm thick split from a 30 mm flat sheet would be expected to have 1.5 to 2.5 waves along its length. These would be more frequent with a 50mm thick sheet and less frequent with 15 mm splits or for trimmed sheets. This waviness would not normally affect the sheet performance and may be further alleviated by trimming of the product prior to splitting through the thickness – note that minimum size specifications detailed earlier (sections 4, 5 & 6) will apply.

vii) Distortion / Bowing (skin/ skin) [Test method : Zotefoams Internal]

Distortion is the maximum curvature of a sheet and is the measured difference between the apparent thickness over the curvature and the actual thickness of the sheet. Distortion is measured using a standard measuring table and for all skin/skin sheets shall be no more than 20 mm.

TABLE 1 : SPECIFICATION FOR DENSITY, CELL SIZE, VOIDS & THICKNESS YIELD

PRODUCT REFERENCE		SHEET DENSITY ^a S/S		CELL SIZE		THICKNESS YIELD
GRADE	VARIANT	MIN (kg/m ³)	MAX (kg/m ³)	MIN (mm)	MAX (mm)	MIN (mm)
F30		29	38	0.15	0.37	s/s nominal -5mm
F35		29	38	0.15	0.37	s/s nominal -5mm
FOSU	F	29	36	0.15	0.37	s/s nominal -5mm
F40HT		31	45	0.1	0.45	s/s nominal -3mm
F40HT	LS	31	38	0.15	0.37	s/s nominal -3mm
F42HT	LS	33	44	0.05	0.3	s/s nominal -3mm
FOSU	SR	32	38	0.05	0.37	s/s nominal -3mm
F74HT		56	93	0.2	0.6	s/s nominal -3mm
F75HT		51	94	0.1	0.7	s/s nominal -3mm
FOSU	R	49	92	0.1	0.7	s/s nominal -3mm

TABLE 2 : MAXIMUM VOID LEVELS BY CATEGORY

	≥1 - ≤ 2 mm [No./m ²]	>2 - ≤ 4 mm [Σ(D) ³ /m ²] ^b	>4 - ≤ 5 mm ^c [No./15m ²]
Category C (all ZOTEK F products)	80	80	1

D = Void diameter in mm on any split surface.

TABLE 3 - FABRICATION TOLERANCES – SPLITTING

<i>SPLITTING FROM SKIN/SKIN SHEETS^d</i>	
Nominal Split Thickness (mm)	cell/cell tolerance (mm)
≤ 5mm	± 0.3
>5 to ≤ 10mm	± 0.4
>10 to ≤ 15mm	± 0.6
>15 to ≤ 20mm	± 0.8
>20 to ≤ 30mm	± 1.0
>30 to ≤ 55mm	± 1.5

^a Cell/cell densities are lower than the densities quoted. The difference will vary depending on grade and sheet thickness.

^b Sum of the cube of the void diameters (in mm) per unit area of foam.

^c Voids greater than 5 mm are not expected to be found except in categories H and K (see note (d) below). Any sheets in other categories found containing such voids are rejected.

^d Different or tighter tolerances (including maximum dimensions) may be achieved, provided they are agreed before the time of the initial order.



TABLE 4 - FABRICATION TOLERANCES – BUTT WELDING

Dimension	Finish	Untrimmed	Trimmed
Nominal Thickness ^e	Skin/skin (s/s) & Skin/cell (s/c)	Sheets will be nominal minimum	Sheets will be nominal minimum, but there may be steps up to 1 mm maximum at the each weld.
	Cell/cell (c/c)	Thickness of the rolls is as s/c split sheet tolerances (see Table 3).	Thickness of the rolls is as s/c split sheet tolerances (see Table 3).
Nominal Width ^e	Skin/skin (s/s), Skin/cell (s/c) & Cell/cell (c/c)	Sheet widths will be nominal minimum, but each weld will be lined up on one side with a maximum error of 6 mm.	Sheet width will be greater than the (nominal trimmed width – 5 mm), but each weld will be lined up on one side with a maximum error of 6 mm.
Nominal Length ^e	Sheets [up to 3m]	Nominal length will be met or exceeded ^e .	
	Rolls [up to 15m]		

Note : Customer should specify Trimmed or Untrimmed, skin/skin, cell/cell or skin/cell when ordering, e.g. Trimmed s/s, Untrimmed s/c. For sizes and tolerances outside those specified please consult the Zotefoams Sales Team.

^e For standard tolerances, no maximum size specified.

TABLE 5 - FABRICATION TOLERANCES

THICKNESS SPECIFICATION		
Nominal Thickness (mm)	Min (mm)	Max (mm)
skin/skin (s/s) and skin/cell (s/c)		
50	- 2	None
70	- 3	None
100	- 3	None
140	- 4	None
170	- 5	None
200	- 10	None
cell/cell (c/c)		
50	- 4	None
70	- 5.5	None
100	- 5.5	None
140	- 6.5	None
170	- 8	None
200	- 10	None
LENGTH & WIDTH SPECIFICATION		
Block Finish	Nominal thickness (mm)	Trimmed Length & Width Tolerance (minimum)
Trimmed	0 mm < t < 100 mm	nominal – 50 mm
	100 mm < t < 200 mm	nominal – 100 mm
	t > 200 mm	nominal – 150 mm
Untrimmed	All thicknesses up to 200 mm (when laminated)	nominal – 100 mm

Note : Customer should specify Trimmed or Untrimmed, skin/skin, cell/cell or skin/cell when ordering, e.g. Trimmed s/s, Untrimmed s/c, along with length, width and nominal thickness requirements. For sizes and tolerances outside those specified please consult the Zotefoams Sales Team.

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